



THE UNIVERSITY *of* EDINBURGH

## Edinburgh Research Explorer

### What are You Thinking? Who Has the Right to Know?

**Citation for published version:**

Wardlaw, J, Wilde, JD, Sandercock, P, Haley, J, Schafer, B, Rae, R & Jarvie, D 2010, *What are You Thinking? Who Has the Right to Know? Brain Imaging and its Impact on Society*. Scottish Universities Insight Institute. <[http://www.scottishinsight.ac.uk/portals/50/brainimaging\\_report\\_final.pdf](http://www.scottishinsight.ac.uk/portals/50/brainimaging_report_final.pdf)>

**Link:**

[Link to publication record in Edinburgh Research Explorer](#)

**Document Version:**

Publisher's PDF, also known as Version of record

**Publisher Rights Statement:**

© Schafer, B., Wardlaw, J., Wilde, J. D., Sandercock, P., Haley, J., Rae, R., & Jarvie, D. (2010). What are You Thinking? Who Has the Right to Know?: Brain Imaging and its Impact on Society. Scottish Universities Insight Institute.

**General rights**

Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

**Take down policy**

The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact [openaccess@ed.ac.uk](mailto:openaccess@ed.ac.uk) providing details, and we will remove access to the work immediately and investigate your claim.





**scottish universities  
insight institute**

mobilising knowledge for a better Scotland



---

## **What Are You Thinking? Who Has the Right to Know?**

---

Brain Imaging and its Impact  
on Society

---

December 2010

---



The University of Edinburgh  
**Edinburgh Neuroscience**



# **What Are You Thinking? Who Has the Right to Know?**

## **Brain Imaging and its Impact on Society**

### **Programme team**

*Scottish Imaging Network, A Platform for Scientific Excellence (SINAPSE)*: Prof Joanna Wardlaw, Director of SINAPSE, Division of Clinical Neurosciences, Western General Hospital, and Dr Janet De Wilde, Division of Clinical Neurosciences, Western General Hospital

*Edinburgh Neuroscience*: Prof Peter Sandercock, Director of Edinburgh Neuroscience, Division of Clinical Neurosciences, Western General Hospital, and Dr Jane Haley, University of Edinburgh

*Joseph Bell Centre for Forensic Statistics*: Burkhard Schafer, Co-Director of the JBC and Co-Director AHRC Centre for Research in Intellectual Property and Technology, member of the steering group of the 'Evidence and Investigation network of the Scottish Institute of Policing Research' (SIPR).

*Futures Forum*, Scottish Parliament: Robert Rae and Donald Jarvie

**The Programme also received support from the following organisations: the Centre for Cognitive Ageing and Cognitive Epidemiology (CCACE), a Cross-Council Centre funded through the Lifelong Health and Wellbeing Programme, University of Edinburgh; the Institute of Physics and Engineering in Medicine (IPEM); and the Guarantors of Brain.**

### **Note:**

The Scottish Universities Insight Institute is a development from the Institute for Advanced Studies (IAS), funded by the University of Strathclyde as a pilot from January 2009. Now a formal partnership of five Scottish universities (Dundee, Edinburgh, St Andrews, Stirling and Strathclyde), we have become the Scottish Universities Insight Institute. As the Brain Imaging programme was funded in a period before the name change, this report refers to the Institute for Advanced Studies (IAS).

### **Scottish Universities Insight Institute**

James Weir Building

75 Montrose Street

Glasgow G1 1XJ

[www.scottishinsight.ac.uk](http://www.scottishinsight.ac.uk)

## Contents

<b>1. Programme purpose and approach .....</b>	<b>1</b>
a. Scope and Objectives.....	1
b. Main questions to be addressed .....	1
c. Main Aims.....	1
d. Format and structure.....	1
i. Part 1: Advances in Neuroimaging and the implications for society.....	1
ii. Part 2: What is the legal view; forensic uses of neuroimaging, ethical considerations, security, privacy and human rights.....	2
iii. Part 3: Influencing policy, Discussion of ethical guidance and practice.....	2
iv. Part 4: Longitudinal Work Package.....	2
e. References.....	3
<b>2. Outputs and outcomes.....</b>	<b>4</b>
a. Areas of thinking explored in each section of the programme and key points emerging .....	4
i. Workshop 1. Imaging: Advances in Neuroimaging and the Implications for Society .....	4
ii. Workshop 2: Law. What is the Legal View?.....	5
iii. Workshop 3, Part A. Members of the public: Summary of main points raised by members of the public participating.....	9
iv. Workshop 3, Part B: Main outputs of the policy makers discussion.....	11
v. Workshop 3. Part C. Scottish Parliament: MSPs and government researchers presentation .....	12
b. Background work package: Online survey .....	13
i. Survey of public opinions .....	13
ii. Survey of “Expert” opinions .....	15
iii. Commentary from independent researcher given access to the project (O. Escobar).....	16
c. Summary of issues and thinking from the programme as a whole.....	18
<b>3. Planned Outputs.....</b>	<b>20</b>
a. Background material and documentation of the workshops.....	20
b. Peer-reviewed publications.....	20
c. Non-peer reviewed publications about the project.....	20
d. Spin off projects and other outputs .....	21
e. Specific recommendations .....	21

f. Taking forward at Government/National level .....	22
<b>4. Overall added value of the programme and its potential impact .....</b>	<b>23</b>
<b>Appendix 1: Programme activities .....</b>	<b>24</b>
<b>Appendix 2: List of participants .....</b>	<b>30</b>

# **1. Programme purpose and approach**

## **a. Scope and Objectives**

Neuroimaging has advanced such that functional magnetic resonance imaging can reveal explicitly an individual's thought patterns. This raises ethical and practical questions that society needs to address e.g. Who should see our brain images? Should neuroimaging be used as evidence in court, in commerce, or by governments? The key objectives of this programme will be to explore the ethical impact of neuroimaging on society. By stimulating debate and gathering opinion between the general public, societal groups (patients, prisoners), scientists, clinicians, ethicists, legal experts and politicians, we will raise awareness of privacy and ethical issues, determine a cross-section of opinion, and through engagement of users and policy makers, publish reports to guide policy outcomes.

## **b. Main questions to be addressed**

1. Who should see our brain images?
2. Should neuroimaging be used as evidence in court (neurolaw)?
3. Should neuroimaging be used in commerce
4. How do different sectors view neuromarketing?
5. Should neuroimaging be used by governments?
6. Should there be a code of practice to guide neuroimaging uses in some sectors?
7. Should users/providers be licensed?

These questions challenge conventional thinking. Neuroimaging is advancing so rapidly that most sectors of society have not realized its full capabilities, applications and implications (some potentially sinister). The serious privacy and ethical issues have not been debated, particularly across a wide range of sectors.

## **c. Main Aims**

This programme aimed to develop a community for debate including academics, government, legal professions, ethicists and the lay public, in order to understand how sections of society perceive and react to the implications arising from advances in neuroimaging. The programme aims; firstly, to understand the context in which neuroimaging has begun to influence different sectors of society, in particular its use in law and in neuromarketing; secondly to study the legal and human rights implications of these uses; and thirdly to consider what constitutes acceptable practice, and whether and how this should be regulated.

## **d. Format and structure**

The programme consisted of two two-day workshops and a third workshop over three days, each with national and international speakers and between 30 and 40 participants, a longitudinal work package, ending in a presentation to the Scottish Parliament:

### **i. Part 1: Advances in Neuroimaging and the implications for society**

A 2-day workshop (6<sup>th</sup>-7<sup>th</sup> May 2010) primarily addressing questions 1-3 above. The workshop covered what is currently possible using brain imaging and debated whether and how brain imaging is appropriately used in legal and marketing contexts. The workshop covered current capabilities and future projected

developments in functional and structural magnetic resonance imaging (MRI), magnetoencephalography (MEG) and molecular imaging methods as applied to legal and forensic use [1,2]; determining moral intent [3]; mind reading, lie detection [4,5]; neuromarketing [6]; the limitations of brain imaging [7]; data management issues including storage, access to brain images for research or clinical purposes, image ownership and privacy. Topics included the blurred boundaries between science and commerce and the potentially subliminal use of brain imaging research for economic gain [8,9,10].

## **ii. Part 2: What is the legal view; forensic uses of neuroimaging, ethical considerations, security, privacy and human rights**

A 2 day workshop (7<sup>th</sup>-8<sup>th</sup> June) focused on uses of brain imaging in law. Speakers included Prof Hank Greely, Prof of Law at Stanford, and Judge Jed Rakoff, Senior Judge from the State of New York.[11] The participants discussed whether it was appropriate to use brain imaging for lie detection, moral intent, establishing criminal responsibility, in the penal system, discussed exemplar court cases and in what if any circumstances might it be appropriate to use brain imaging in law.[12,13] The need for regulation of forensic technologies was discussed. Six key points were addressed: 1) is the technology reliable enough to support legal decision making? 2) Does it answer the questions the law asks, or is there a conceptual mismatch? 3) How do the answers to 1 and 2 influence the boundaries between legal and medical intervention? 4) Can the science (and its limitations) be reliably communicated to the legal profession (judge, jury or probation officer)?[14] 5) If punishment is based on this technology, can this be presented so as to avoid loss of respect for the legal system by the general public? 6) Are there any legal reasons why the technology should not be used even if the answers to all these questions are yes?

## **iii. Part 3: Influencing policy, Discussion of ethical guidance and practice**

Scotland's Futures Forum (SFF), a non party-political organisation owned by the Scottish Parliament's Corporate Body, co-ordinated the third workshop in two parts, the first for the lay public in a World Café style debate and the second for policy makers, culminating in a presentation to MSPs at Holyrood. *Event 1*: on 25<sup>th</sup> June included 45 lay members of the Forum who heard a summary of outputs from the two prior workshops, debated key topics, considered exemplar court cases, and provided feedback. *Event 2*: on 19<sup>th</sup> August, assisted by the Scottish Government's Chief Scientist's organisational networks and attended by Prof Anne Glover Chief Scientific Advisor, included 50 policy makers. Professor Jonathan Moreno, expert in biomedical ethics, advisor to the White House Office of Science and Technology Policy, co-chairman of the Committee on Guidelines for Human Embryonic Stem Cell Research in the USA, provided an international perspective. Debate focused on any requirement for regulation, other methods of encouraging public awareness and ways to engage Government. A summary of the conclusions from all three workshops was presented to MSPs at Holyrood (*Event 3*) on 29<sup>th</sup> Sept. The presentation was attended by the shadow Education Minister, a member of the Health Committee and researchers. It was preceded by a publication in the journal *Holyrood* on brain imaging.

## **iv. Part 4: Longitudinal Work Package**

The workshops were underpinned by a substantial amount of background work including an extensive survey of media representations of neuroimaging culminating in a systematic review of uses of imaging outside traditional medical diagnosis or scientific research, creation of multiple summary posters, several interviews with science journalists (eg Holyrood, the Glasgow Herald, BBC Scotland). An online survey was designed using 'Survey Monkey' to obtain the opinions of non-expert members of the public and those with

expertise in neuroimaging on wider uses of neuroimaging and whether it should be regulated. The surveys targeted the public and neuroimaging experts (e.g. psychologists, radiologists, neuroscientists), through dissemination in the media, professional society circulation lists, organizations like Beltane, and websites (SINAPSE, Edinburgh Neuroscience, SCRIPT, Joseph Bell Centre (JBC), Futures Forum), science blogs and other websites. The survey ran from the 2<sup>nd</sup> workshop until 30<sup>th</sup> Sept 2010.

## **e. References**

1. Aggarwal N.K. J Am Acad Psychiatry Law 37:239–44, 2009;
2. Batts S. Behav. Sci. Law 27: 261–272 (2009);
3. Harenski, C.L., doi:10.1016/j.neuroimage.2009.10.062;
4. Langleben D.D. J Am Acad Psychiatry Law 36:502–4, 2008;
5. Simpson J.R. J Am Acad Psychiatry Law 36:491–8, 2008;
6. Lee N. International Journal of Psychophysiology 63 (2007) 199–204;
7. Martell D. Behav. Sci. Law 27: 123–136 (2009).
8. Neuromarketing: Companies Use Neuroscience for Consumer Insights, Laurie Burkitt, 10.29.09, 02:00 PM EDT, Forbes Magazine dated November 16, 2009;
9. Neuromarketing and consumer free will, Journal of Consumer Affairs, Fall, 2008 by R. Mark;
10. <http://neuromarketing.ning.com/>;
11. Complex Brain Imaging Is Making Waves in Court, Publication Date: October 17, 2008, Source: San Francisco Chronicle, Author: Reyhan Harmanci also at <http://storybank.stanford.edu/stories/complex-brain-imaging-making-waves-court>;
12. Brain Imaging and Criminal Law, May 04, 2009, by Astrid Fiano, DOTmed News Writer;
13. The court will now call its expert witness: the brain. November 20, 2009 by Ingfei Chen, <http://www.physorg.com/news177927125.html>.
14. House of Lords (HoL) "Forensic Science on Trial" 2005.



## 2. Outputs and outcomes

### a. Areas of thinking explored in each section of the programme and key points emerging

#### i. Workshop 1. Imaging: Advances in Neuroimaging and the Implications for Society

Forty neuroradiologists, neurologists, neuroscientists, psychologists, psychiatrists, physicists, lawyers, ethicists, political scientists, philosophers, social scientists, science journalists and imaging and law students met for the first of a series of workshops, to discuss the emerging wider societal implications of brain imaging. After two days of expert talks, panel question and answer sessions, discussion groups and feedback, the main conclusions of the group were as follows.

1. Although neuroimaging techniques are already in use in law, marketing and are being considered for use in public security, this is at present without a secure scientific foundation. Since the potential applications, implications and economic impact of neuroimaging are so substantial, they mandate:
  - a) an informed public debate and
  - b) further research to underpin these wider uses.
2. The group expressed concern about the increasing use of neuroimaging techniques, particularly functional neuroimaging, as evidence in a court of law, in marketing or in public security. However, the neuroimaging scientists and clinical academics recognise that the increasing use of these techniques is simply a consequence of the need for improved assessment methods in these sectors.
3. Diffusion of neuroimaging into areas beyond basic science (e.g. law, marketing, public security) indicates a need for increased research and greater academic engagement to ensure that the methods and interpretation are fit for purpose in these new settings.
4. The tendency to extrapolate the results of neuroimaging research well beyond the subject group or setting in which they were originally derived is potentially harmful both to the original research and to the groups or individuals to which the data might be applied.
5. There are many – often not well understood – implications involved when extrapolating from data derived from research studies obtained in groups of participants in focused traditional neuroscience research settings, to imaging results obtained from a single individual in a setting that may be very different to the original research environment.
6. It is important to make sure that the results of scientific research are applied correctly when applied in a new field. One must take account of the population and setting in which the research was originally conducted. So, the interpretation for a test designed to be performed in a psychology laboratory environment would be very different if the test was to be undertaken in a different setting or its results applied for other purposes (e.g. legal or security).
7. Much larger amounts of normative data, from both structural and functional neuroimaging across people from many backgrounds, ages and cultures are required, both
  - a) to enhance understanding of research outputs of neuroimaging and,
  - b) to inform its wider use outside the traditional research fields by other sectors.

8. Neuroimaging scientists should both strive to build databanks of normal data from data already collected and ensure that future collection of imaging data from normal subjects can be added to such normative image banks to inform future research.
9. Those involved in the conduct of neuroimaging research in academic science environments should recognise that the results expressed as an image can be highly compelling and may be disproportionately persuasive compared with other forms of evidence. They should be cautious in how they communicate the results of their research both to peers, the media and the public to avoid being the source of unreasonably positive or negative messages.
10. Those involved in the conduct of neuroimaging research in academic and science environments should be aware of the inherent conflict of interest between the need to publish high-quality research, achieve high academic impact, the increasing pressure to have a media presence, and the risk that these pressures will distort the interpretation of their research results.
11. Communication between the different sectors and stakeholders involved in using neuroimaging technologies is poor and needs to be improved. Equally, communication of results of neuroimaging research by neuroimaging researchers to the media, and in turn by the media to the public, needs to be improved.
12. Media communication should be improved specifically:
  - a) To give the public greater objectivity in interpreting information provided in the media,
  - b) To improve objectivity in assessment of imaging as evidence in any context,
  - c) To be clearer about what the results of imaging add to existing assessment tools, for example, to a range of different forms of evidence that might be provided in court or a range of market assessment tools.
13. Guidance for conduct and presentation of neuroimaging, particularly functional neuroimaging, experiments such as are available for other forms of research (see EQUATOR Network, <http://www.equator-network.org/>) would be valuable and could help avoid many of the methodological errors and consequent biased assessment of the value of some neuroimaging experiments in the past.
14. Given that neuroimaging is a rapidly advancing and complex field, neuroimaging scientists should be aware of and open to re-evaluation of previous results, consideration of adoption of new research designs, and be open to radically new interpretations that may mean that prior understanding of neuroimaging data is shown to be seriously flawed.

## **ii. Workshop 2: Law. What is the Legal View?**

Thirty-seven lawyers, judges, philosophers, political scientists, Church representatives, sociologists, neuroradiologists, neurologists, neuroscientists, psychologists and bioethicists met for the second part of the debate on Brain Imaging and its Impact on Society, “What are we thinking? Who has the right to know?” After two days of expert talks, panel question and answer sessions, consideration of four exemplar court cases, discussion groups and exercises to construct a series of frequently asked questions for lawyers and neuroscientists, the main conclusions of the group were as follows.

1. Because of the importance of mental states in defining criminal offences and defences, from the all important concept of intent to the insanity defence, the temptation to use results from neuroscience in a legal context will be high. While the issue of establishing actus reus, the factual aspect of a crime, has profited on a massive scale from modern science such as DNA, proving the mental element of an offence has remained as difficult as it was in the 19<sup>th</sup> century. The mere promise of addressing this difficulty is likely to put pressure on substantive and procedural criminal law, as already seen in other jurisdictions.
2. The continuing reliance on eyewitness evidence and confessions, despite the increasing recognition of their unreliability, will put further pressure on using a “technological fix” that could give these ancient forms of evidence a modern, scientific seal of approval.
3. There was strong consensus that attempts to replace core legal concepts such as intent by neuroscience based vocabulary as is discussed in several continental European jurisdictions in particular, let alone giving up the notion of personal responsibility or free decision making on which the criminal law depends, are very premature. There is no strong scientific case to be made at this point in time to require revisiting these concepts, and there are some good methodological and philosophical reasons why even further progress in science is unlikely to change this assessment. Misrepresentation in the media needs to be addressed not just by scientists, but also lawyers and philosophers that can communicate the difference between legal and scientific notions of intentional decision making.
4. There was general consensus among the legal professionals present that there is at present little place for use of brain imaging in court to establish a diagnosis of mental illness, for lie detection, to determine intent, personal preferences or behavioral traits. While neuroscience has made impressive progress in some of these fields (and in some much more than in others) the prejudicial effect on the jury is too high, and the difficulties to quantify the reliability too serious. The last point is worth emphasising – we need to know not just the positive results that have been achieved, but also the limitations and failures of the technology.
5. More generally, there is a danger that an “illusion of knowledge” is created with little guidance or insights into how to use this knowledge responsibly, or indeed what to do with it at all. This is potentially dangerous for public discourses about risks, such as the risk of (re)offending, the risk to suffer from an illness, etc.
6. There is a risk that results are used that have little to no ecological validity in forensic settings. Results achieved with very limited sample size, and from non-random populations (typically students) may not be valid in the general population, or the subsection most likely to come into contact with the legal system.
7. The use of images in addition carries the risk of being prejudicial when used in front of a lay jury who lack scientific training, and to distort the true evidential value. At present, expert witnesses testifying on court are mainly traditional scientists with little or no dedicated forensic training. Dedicated forensic research, and training into appropriate and law-compliant communication of these results, is needed. Equally needed are standards for the presentation of evidence, such as uniform colour schemes – we recommend indeed not to use the images at all and rely solely on verbal statements, but this requires further research.

8. The experience from the US indicates that a principled approach to the admissibility of evidence provides some efficient safeguards, but also shows that commercial operators of debatable quality will soon become active in legal fields such as employment disputes or criminal sentencing/parole board decisions, etc, where these safeguards do not apply.
9. For the UK, reviving the idea of a "Forensic Science Advisory Council" as suggested by the "Forensic Science on Trial Report" by the House of Commons Select Committee, to act as gatekeeper for new types of evidence would be a useful approach also to inform on areas of neuroscientific evidence, but also on other emerging areas of science that face similar issues. Great care needs to be taken that less regulated fields of legal decision making such as civil procedure, or in a criminal setting, sentencing and bail decisions, do not become "beachheads" for the use of neuroscience. For this reason, reviving the FSAC model is likely to be more efficient than adopting the US Daubert criteria for admissibility of expert evidence, which would only regulate criminal trials.
10. Learning from the experience in computer forensics regarding e.g. standardisation of tools and equipment would be beneficial, as would be standards for presenting neuroscientific evidence in court. Neuroimaging is an interdisciplinary field, and an appropriate professional body for accreditation of experts need to be found – a problem also faced in other disciplines., indicating the need for a regulation of forensic scientists qua forensic scientists, outside and in addition to their "home disciplines".
11. In addition to the reliability of the evidence, other factors also need to be taken into consideration, in particular privacy concerns - this debate is in its infancy so far in the US and UK, but more developed in Germany and Spain. There, the use of neuroimaging for lie detection is deemed a violation of human rights to both privacy and a fair trial, a position that may well also be taken by the European Court of Human Rights. In the UK, the right against self-incrimination also needs to be explored in relation to fMRI.
12. Privacy issues also need to be addressed when it comes to storage and handling of brain images, and their potentially biometric nature needs to be taken into account when developing privacy law compliant regimes. Since it is possible from the image of the brain folds to uniquely identify a person, they are personal information under data Protection law. Great care has to be taken to protect privacy while at the same time permitting important research to continue, and legislative action may be needed to permit researchers to conduct studies without fear.
13. Analogous application of the Human Tissue Act, or an explicit extension of the provision of this act to brain images, needs to be discussed.
14. Reuse and third party use of results from both research and forensic cases, especially by insurance companies, needs to be examined. A moratorium along the lines of the moratorium on use of DNA results by insurance companies might require discussion. Volunteers for research, or people willing to undergo scans in a legal setting, should not suffer detriments when incidental findings also show health issues.
15. Despite these concerns, care also needs to be taken not to use overly restrictive regulation as this might regulate inappropriately for use of imaging in the wider context, for example.

16. Informed public and professional debate will be important to encourage society to consider the implications and ensure that any future regulation would be evidence-based.
17. There is significant need to ensure that the public is informed about the limitations and implications of brain imaging both in medical practice, neuroscience research and any possible wider uses.
18. There is a need for more research into the wider uses of brain imaging, in particular from a neuroethics perspective. The group noted examples of national funding for enhancing the neuroethics debate in some countries, such as the Canadian Neuroethics Network, and agreed that this was an exemplary approach.
19. Neuroscience and neuroimaging can play a more prominent role in societal and sociological research, for example in longitudinal studies of development, so that neuroscience can contribute to our wider understanding of brain function – society interactions.
20. Communication between researchers across disciplines to remove interdisciplinary barriers should be strongly encouraged. This would be facilitated by strategically placed interdisciplinary PhDs or post-docs jointly hosted, for example, in law and neuroimaging.
21. Information concerning neuroscience and forensic uses of imaging should be incorporated into training of lawyers even if only on a minimalist basis given the already full timetable. The Judicial Studies Board or possibly the Law Commission should be encouraged to consider inclusion of forensic uses of neuroimaging as part of their CPD offerings, or as part of the undergraduate legal curriculum where there is an increasing need for introductory courses in forensic sciences in general.
22. Neuroimaging scientists should be encouraged to speak to the media to help improve public understanding and awareness, but need to be aware of the wider philosophical and societal issues their findings can trigger. Interdisciplinary training for science communication is necessary
23. Potential implications of licensing of fMRI operators should be explored. Experience from the US shows that companies with sometimes problematic track record and approaches are likely to offer services targeted for legal use (e.g. employment issues) which could also increase the pressure on the legal aid budget.
24. Consideration should be given to the implications of regulating non-medical uses of neuroimaging, including possible health effects of reiterated screening (e.g. when screening is used for mortgage applications).
25. The formation of normative banks of neuroimaging data should be encouraged. Benchmarks of this type are also important to be able to report error bars, as is increasingly required by courts when dealing with expert evidence, and a foral requirement in the US under the Daubert criteria.

### **iii. Workshop 3, Part A. Members of the public: Summary of main points raised by members of the public participating**

26 members of the public from the Futures Forum with five representatives of imaging experts and the organisers of Futures Forum met at the Institute of Advanced Studies, University of Strathclyde, Glasgow on Friday 25<sup>th</sup> June 2010 to discuss brain imaging and its impact on society.

Several themes emerged from discussions during the course of the day and during the final feedback sessions.

#### **Distinguishing between different uses of imaging**

Participants felt that it was important to distinguish different uses of imaging, as these represented different levels of acceptability and any need for additional regulation. Thus, the participants were unanimous about the benefits of imaging used in medical practice where there were clear benefits to the individual as well as to society. The use in research, which might not benefit the individual but in the long-term would hopefully benefit society, was already addressed by research ethics committees. Beyond that the benefits both to the individual and society were much less clear cut, e.g. where someone pays because they want to have a scan, in commercial or some legal uses. Finally, there would be a situation where an individual could be forced to have a scan, such as for security, in the penal system or for legal reasons.

#### **Regulation**

1. Regulation of imaging technology when applied outside medicine was considered to be key and participants were keen to talk to government concerning this. They saw a government role as key and welcomed the role of Parliament but acknowledged that all governments would need to move in the same direction towards a regulatory framework, not just Scotland.
2. There was strong advocacy for a regulatory body covering use of forensic evidence, including imaging, such as was proposed for the Forensic Science Advisory Committee.
3. In many circumstances there were already regulations which, if applied appropriately, would cover use of imaging outside medicine and ethically regulated research.
4. If politicians were to ensure that existing legislation regarding assessment of employees were enforced, then any use of imaging under those circumstances would probably not be allowed and therefore the regulation of use of imaging by employers would probably not require new legislation. A change in technology from some older method to imaging does not alter the principle that lie detection or other forms of assessment with imaging is wrong at interview.
5. There was scepticism concerning the motives of large commercial organisations with interests primarily focused on profit and was little confidence in industry self-regulation or transparency of techniques.
6. Use of imaging should be heavily regulated to prevent use of data in unregulated ways. This would include greater regulation of retention of employment records (currently voluntary) and transparency of access and usage.

### **The need for expert knowledge**

1. A scan was seen as a snapshot or photograph and somewhat meaningless without expert interpretation.
2. Images were recognised to be more compelling than traditional verbal descriptions of evidence and as such needed to be used cautiously.
3. If images were to be used in court, then this should only be with expert interpretation and with guidance from the judge to the jury on how to use the information given.
4. There was considerable cynicism regarding the 'social' uses of imaging and it was recognised that it was important to understand the subject very well in order to avoid advancing in the dark in these areas.

### **Imaging seen as being no different to other forensic technologies**

1. Imaging was seen as a psychometric tool, and little different to other technologies used for similar psychometric purposes such as lie detection or detecting personal preferences, and therefore should be regulated just like any other psychometric tool.
2. As regards use of imaging in marketing or industry, the group was not convinced that imaging was any different to any other forms of subliminal marketing that were already regulated.
3. Use of imaging, e.g. as part of employment assessment, raised a number of complex issues, not least of which were potential infringements of disability laws and civil rights, both of which were already covered by existing regulatory frameworks. In the case of employers using lie detection equipment, the group recognised that in some jobs, lying could actually be regarded as a good attribute! It was felt to be narrow-minded and short-sighted of employers to use scanning in place of taking account of the individual's background, experience, performance at interview or references.
4. It was recognised that the results of a functional imaging study obtained from the same person could be very different in different contexts and depend on cultural interpretation, mood-related factors and change over time. Overzealous usage of such techniques, without due regard to context and awareness of reliability of evidence, might result in adverse labelling of subjects which would be difficult to shake off and could result in significant disadvantage to the individual depending on the societal morality and cultural contexts.

### **Wider understanding of imaging science**

1. There is a need for more qualified scientists to work as journalists and for more scientists to participate in government.
2. Politicians need greater understanding of technologies, not just imaging.

#### **iv. Workshop 3, Part B: Main outputs of the policy makers discussion**

Policymakers and representatives from key governmental and professional organizations met to hear and discuss the main conclusions of the previous three meetings. The main points arising were as follows.

##### **Searching for principles**

Much of the discussion concerned concepts of cognitive liberty, who has or should have access to an individual's personal thoughts and issues of self incrimination should thoughts be accessed inappropriately.

1. It was recognised that neuroimaging had the potential to intrude on individuals' thoughts, but it was unclear as to how far science should go, where to draw the line, and that there are some questions that we should not ask even if the technology is capable of addressing these.
2. The point was made that live dissection is not and has not for many decades been considered acceptable in a law-abiding civil society, so why should we allow mental dissection? This has parallels with legal standards which say that evidence obtained by torture, no matter what the pretext, is unreliable, offensive and inadmissible in court.
3. There was a sense that the use of neuroimaging technology outside of medicine or rigorous scientific research should be "parked for a decade" for understanding to mature and society to catch up with understanding implications of potential uses.

##### **Need for regulation of neuroimaging uses**

1. There are currently no regulations to guide how expert witnesses should be selected. Expert witnesses may not be adequately qualified to comment on specific forms of forensic evidence in court. Minimum standards for expert witnesses to act in the field of neuroimaging (as well as other forensic technologies) should be established.
2. Admission of forensic evidence in court is not based on any standard at present in the UK, although there are standards in other countries. The Governments should be encouraged to implement a Forensic Science Advisory Committee, as suggested in a previous House of Commons Select Committee report.
3. A watchdog to monitor commercial and "direct to consumer" uses of neuroimaging should also be considered as these uses would not be covered by a forensic committee and a watchdog approach would be more relevant to non-traditional uses of neuroimaging to which the general public might be exposed.

##### **Interdisciplinary working**

1. Scientific literacy amongst many sectors of society, including lawyers and politicians, is poor even though society is totally dependent on science and technology. Most science and technology is invisible to the public and many may not be very interested.
2. There is a clear need for more integrated working at all levels of training between medical and scientific researchers and lawyers and policy makers. This would enable the researchers to direct their science towards questions that are raised on uses of neuroimaging in legal/forensic situations.



3. Some caution would be required as to how this would be achieved to ensure that appropriate research is supported and avoid the pitfall of “reindeer science” (if you fund research on reindeer then many groups will start making their research relevant to reindeer).

#### **Scepticism should not impede valuable medical and scientific progress**

1. Scientific progress is a fact of life and society should aim to benefit from the advances while not suffering from adverse consequences.
2. Prohibition rarely works and could impede important scientific progress.
3. Communication of capabilities/risks of neuroimaging to society is essential. Neuroimaging could learn from other technologies as to good and bad ways of achieving optimum communication.

#### **Policy**

1. In forming policy, evidence is often ignored and there may be a lack of transparency. Policy may be driven by popular opinion/perception rather than evidence.
2. Few scientists enter politics, few special advisors or politicians or civil servants have a scientific background and few have any training in how or where to obtain objective and balanced information when they require to do so. And may resort to contacting a colleague who they think might have some relevant knowledge (a haphazard approach).
3. It is difficult for scientists to engage in the formation of policy as there are few channels for representation and scientists/medical experts may be seen as “remote” and “hard to understand”.
4. Scientists/medics should take more interest in engaging with politicians at all levels. Mechanisms include student/early post doc exchanges with government research offices, through to easy availability for expert advisory groups.
5. Principles to help engage politicians in having greater awareness of the implications of neuroimaging and in forming any guidance are likely to include ways in which neuroimaging might impact on formation of a fairer, safer, society and efforts to increase accessibility to expert scientists and medics.

#### **v. Workshop 3. Part C. Scottish Parliament: MSPs and government researchers presentation**

Twenty-one participants from the earlier workshops attended the Scottish Parliament at Holyrood and presented a summary of thinking to date at a lunchtime meeting. The meeting was attended by two MSPs (Shadow Education Minister and member of Health Committee), several researchers and committee representatives (the attendance was less than anticipated due to late running sessions).

MSPs and researchers were clearly interested in the topic and concerned about how to take this forward. There was discussion of self regulation (about setting standards) versus state regulation (control of specific uses) with analogies to other technologies such as DNA and fingerprinting; about differences between the Scottish and Westminster legal systems that might have impact on this topic; safety aspects of scanning outside medical environments; other options for raising awareness amongst MSPs and civil servants and for determining the level of any government input/control.

*There was interest in spreading awareness of issues raised by the programme through a range of mechanisms including:*

1. Discussion in the annual debate on Science;
2. A member's debate;
3. Presentations to committees including Justice, Health, and Science and Technology;
4. Tabling of Parliamentary Questions, for example, a question to the Justice Minister might be "What consideration has the Minister given to the regulation of brain imaging in non-medical settings?"
5. Presenting to the Scottish Science Advisory Committee;
6. Secondments of up to two to three months for PhDs or post-docs into Parliament would be valuable, an outcome that had already been suggested in the Workshops.

## **b. Background work package: Online survey**

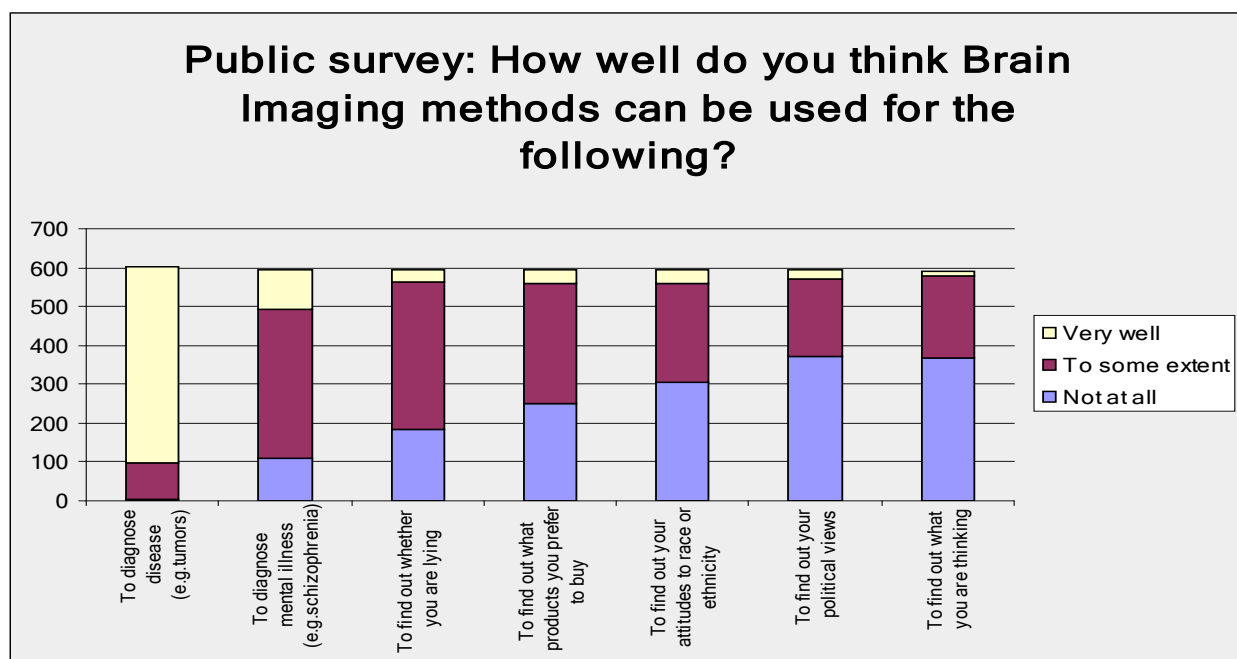
Two surveys were designed to obtain as broad as possible a sample of public and expert opinion on wider uses of neuroimaging. A prototype survey was designed and tested internally and reviewed at the first workshop. Changes were adopted and the surveys went live in early June 2010.

The following is a snapshot of the responses to the survey as at 24<sup>th</sup> October 2010. Final results are unlikely to change materially.

### **i. Survey of public opinions**

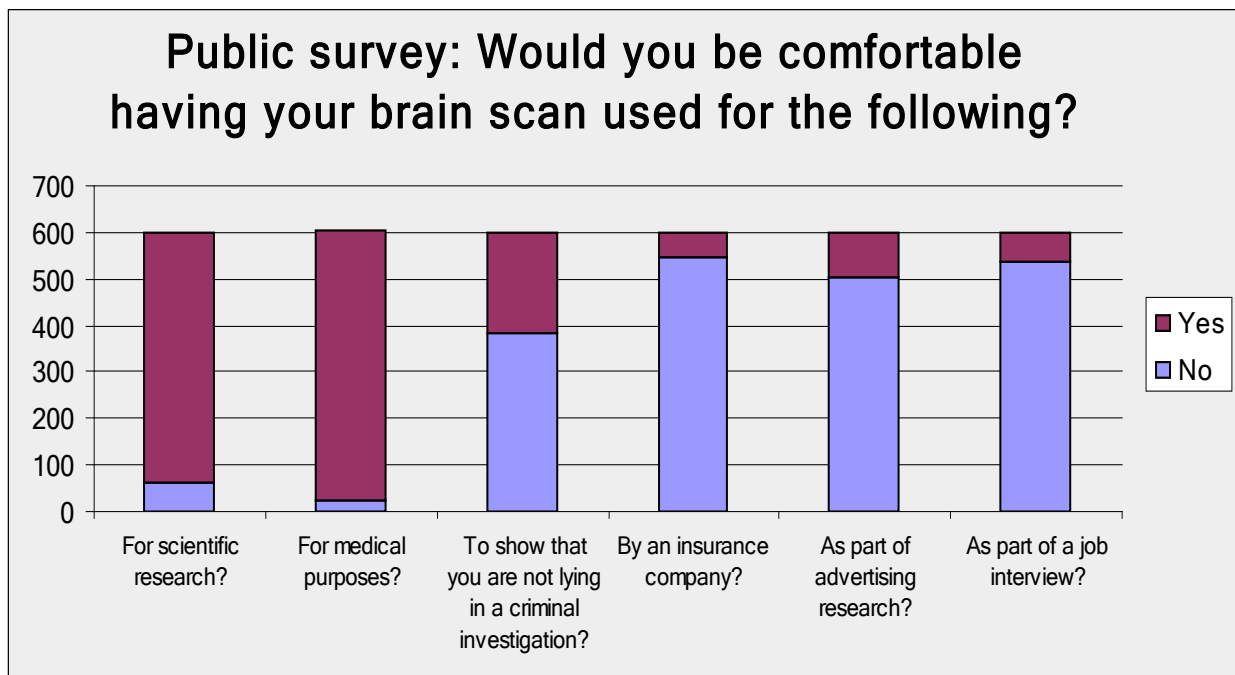
Six hundred and fifty five subjects responded. The majority thought that neuroimaging was able to diagnose neurological diseases such as tumours, but probably was not able to identify consumer preferences, ethnic prejudices, political views or to interpret thoughts (Fig 1).

*Figure 1*



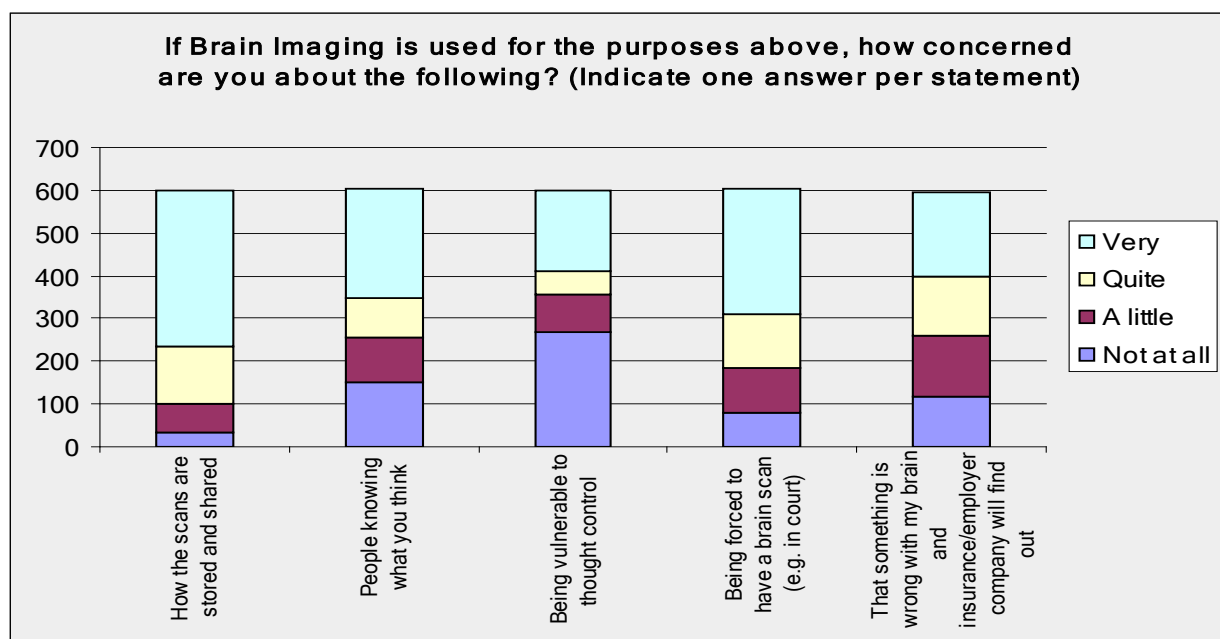
Most respondents were happy for their neuroimaging to be used for scientific or medical research, but less keen on lie detection, use by insurance companies, employers or in marketing research (Figure 2).

Figure 2



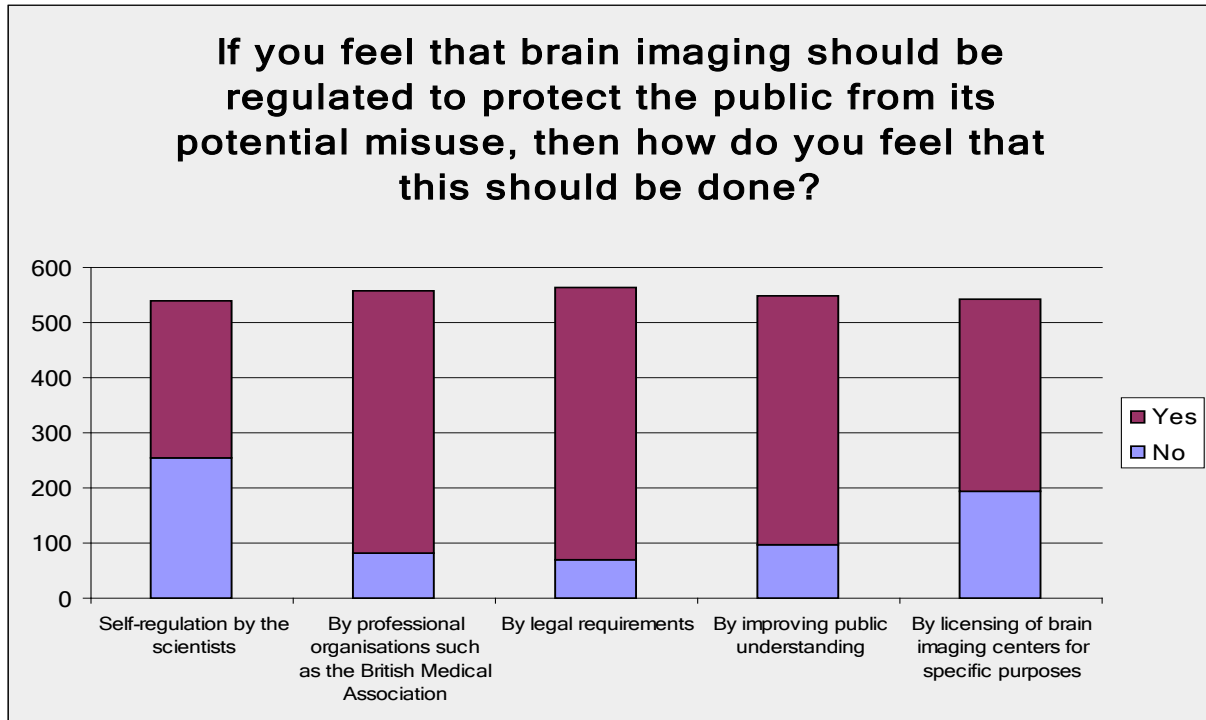
Most respondents were concerned, often very concerned about data storage, privacy and access issues (Figure 3).

Figure 3



Most respondents thought that regulation was a good idea but did not favour self regulation by researchers or by licensing of imaging centres. Rather, there was a preference for regulation by professional organizations or implementing some legal requirements (Figure 4).

Figure 4



## ii. Survey of “Expert” opinions

303 individuals responded to the Expert Survey. Approximately equal thirds had <5 years, 5-10 years or 10-20 years experience with neuroimaging. The majority of respondents in the Expert Survey report using neuroimaging for neuroscience research (65%), followed by clinical research (47%), medical diagnosis (35%), neuromarketing (4%), for forensic purposes (4%) and for security purposes (1%).

Most respondents were aware of the use of neuroimaging outside traditional research (84%), particular for neuromarketing (56%) and lie-detection (57%). Moderate levels were reported for legal uses (41%), neuroaesthetics (47%), cognitive enhancement (47%) and mind reading (39%). Little awareness was reported for security purposes (9%).

Respondents had little awareness of how frequently neuroimaging had been used in court in the USA, most estimating no more than 30 times in the last five years.

Most felt that professional guidelines were the best strategy for regulating uses of neuroimaging (37%), then professional guidelines (36%), improved public awareness (25%) and funding for interdisciplinary projects integrating neuroscience and law (24%). 64% fear the over regulation of neuroimaging in research. There was strong support for public education (76%), interdisciplinary projects (71%), and professional guidelines (70%).

Although most respondents believed it was important to communicate their results to the public (67%), most said that they do not regularly engage with the media (51%), citing little opportunity (66%), little incentive (40%) and distrust of media (29%) as their main reasons, followed by a lack of public speaking training (16%) and a fear of criticism (6%). When asked how this situation might be improved, the majority rated as quite or very effective professional credit for public engagement (70%), funding requirements (57%) and public exposure of research (71%), followed by outlets for a career in media (24%).

Most (82%) felt that neuroimaging was not accurately portrayed in the media, the main reason given being poor journalism (54%), followed by exaggerated results by researchers (43%), a lack of effective scientific communication (31%) and poorly conducted research (36%). Although many believed that increased exposure to neuroimaging research will raise its public profile as a beneficial technology (90%), 75% foresaw a public backlash to the widespread use of the technology.

### **iii. Commentary from independent researcher given access to the project (O. Escobar)**

Scientific communities and policy networks around the UK have come to recognise the importance of fostering ‘upstream public engagement’, that is, early public dialogue around potentially controversial scientific advances. It is said that upstream engagement allows for substantial reflection and discussion, and thus contributes to avoiding the kind of public outrage and media misrepresentation that has jeopardised other research agendas in the past.

Both popular media and research literature have provided countless accounts of the reactive *modus operandi* that often characterises scientific and policy communities when it comes to potentially controversial science. Scientific communities have been accused of lack of transparency and accountability to the public, as well as of being so immersed in their own research agendas that they ignore the wider societal impact of their work. Policy-making bodies, in turn, have been accused of lacking in capacity to anticipate scientific controversies before they explode in the public media, when it is already too late to do anything but swimming with the tide of public opinion.

The Brain Imaging Dialogue represents, at least in part, an example of a substantially different approach. Here we find a scientific community that, in the face of increasing internal concerns, decides to take a proactive role. In cases like this, there are always various options on how to go about it. The most common way of operating is to assemble a small group of elite experts charged with the task of giving a verdict on the subject in order to inform policy. This is the classic technocratic approach to informing policy making. However, this canon of practice is widely criticised, and the critique has also been taken on board during the last decade by policy networks and research funders alike. The alternative seems to be to move towards more participatory approaches, whereby broader networks are included in dialogue processes.

Such dialogue processes are now often encouraged, if not mandated, by research funders. This is done mostly through grant application requirements to stipulate what sort of public engagement a research team is planning to do as part of a new project. In some scientific communities, this requirement is increasingly seen as an imposition, a sort of permanent duty to renegotiate their ‘license to practice’. Some researchers within Science and Technology Studies have criticised this top-down approach to mandating public engagement, because too often it seems to work out in detriment of the quality of such dialogue processes. Accordingly, some commentators are advocating instead for more genuine bottom-up initiatives.

The Brain Imaging Dialogue represents an example of one such bottom-up initiative. It is the case of a scientific community –a Scottish neuroimaging network- that takes a proactive stand in the face of their concerns regarding non-medical uses of Brain Imaging Technologies. Instead of simply looking inwards, assembling a group of elite neuroscientists and adopting a traditional lobbying approach, the project initiators looked outwards and aimed at bringing together cross-disciplinary voices and stakeholder views in a complex dialogue process. In order to do so, the organisers sought ad hoc funding. In other words, they did not *have* to do it; it was not a mandated, but rather a proactive and inclusive move.

The length, breadth, and depth of this dialogue process are described elsewhere in this report. In addition, further independent analysis of the process itself, as a participative and deliberative project, is also being undertaken beyond this report. For the purposes of this section, however, it is important to highlight the innovative nature of the project. Instances of scientific communities engaging widely with other disciplines and publics are rare. The organisers of the Brain Imaging Dialogue recognised from the outset that their issues and concerns have wide ethical, social and political implications. They acted accordingly, creating a broad platform that included both experts and non-experts in order to look at the issues from a variety of perspectives.

Taking such a collaborative, interdisciplinary, and participative approach is far from being the easy option. It presented many challenges, for instance, regarding the difficulty of communicating across disciplinary, ethical and epistemological divides. That is, across different ways of understanding, judging, and expressing the complexity of the issues at stake; issues that are typically characterised by the entwinement of facts and values. Nevertheless, the process also presented well-accomplished opportunities. In particular, it created a safe space for informed and open dialogue and deliberation, that is, a space free from the rush and superficiality that too often characterise media and political debate. All in all, the process represented a departure from the well-known frameworks epitomised in the expressions ‘science for society’ and ‘science in society’, and a move towards more innovative and integral approaches to ‘science with society’.

When it comes to science and technology, being proactive in terms of public engagement is ever more encouraged by policy making and research funding bodies. Yet, it remains to be seen whether the outputs from this kind of upstream engagement are actually taken seriously in decision-making arenas. Otherwise, there is not much point in having proactive and publicly engaged scientific communities, if policy-making bodies are to remain reactive when it comes to potentially controversial science. To be sure, this does not mean that decisions should or could be made based uniquely on a dialogue process, no matter how ambitious or comprehensive it was. What it means is that processes like the Brain Imaging Dialogue provide the necessary groundwork to enable further policy deliberation to get under way timely, rather than reactively.

### **c. Summary of issues and thinking from the programme as a whole**

The overarching principles that emerged during the workshops were that evolving technology is a fact of life and that, like a language, technology is a living changing entity that evolves through interactions with society. We should try to reap the benefits of the best aspects of new technologies while not falling foul of the problems or suffering inadvertently from the adverse effects on society.

1. The overwhelming conclusion from medical, scientific and legal experts, and informed members of the public, was that there was little scientific validity for current use of imaging in law, commerce or security.
2. However, the workshop participants all recognised that the increasing use of imaging in these areas was simply an indication that the forensic, commercial and security sectors felt the need for improved methods to determine the validity of evidence, consumer preferences, etc.
3. Lawyers, medics, scientists need to talk to each other more to make sure that new technologies are used appropriately.
4. More cross-disciplinary research at the interface between imaging and law, government and commerce is required to ensure that new technologies are used appropriately.
5. Guidance for conduct and presentation of neuroimaging data to help standardise content of articles, as for other types of research study, would be valuable.
6. Public engagement and informed public debate is essential to help the public to judge future uses of neuroimaging. Without this, there is a risk of damaging the credibility of good uses of imaging and public distrust of scientists + medics, as occurred with genetically modified foods, genetic engineering, climate change, etc.
7. Scientists and medics should actively engage with the public to explain their results in an easily understandable way, including the limitations and drawbacks of their research.
8. Society must be able to interpret and apply the results of this research wisely.
9. There is a need for expert groups to be able to advise lawyers, government, other bodies on forensic uses of neuroimaging. This could be achieved through establishment of a “Forensic Science Advisory Committee”.
10. There is a need to establish standards for imaging experts in court or in any other capacity as an expert witness.
11. Experts should be more accessible to the public and to government and other groups who may seek their opinions on wider uses of neuroimaging. Providing such advice should not be seen as intrusive or an unnecessary demand on time. It is part of the responsibility of the scientist to communicate the results of their research to the public and other interested bodies.
12. A watchdog to monitor and comment on emerging alternative uses of neuroimaging would be valuable for society.

13. There are, however, some serious safety issues when scanners are operated outside traditional scientific/medical settings by users with commercial interests who may be less aware of the potential dangers. These range from damage from metallic missiles, to subjects with specific contraindications to MR imaging, to the consequences of incidental findings with life threatening significance.
14. Prohibition of use or over-regulation of use could well impede important scientific progress and in any case, generally does not work, and may even backfire and end in ridicule or alienation of those proposing the increased regulation.
15. An enlightened society should encourage good ethical and regulatory frameworks and codes of practice so that imaging technologies can benefit society and not fall into disrepute – *Scotland first*



### 3. Planned Outputs

The following were planned prior to the programme or developed during the programme as new opportunities arose. New opportunities for dissemination are still arising.

#### a. Background material and documentation of the workshops

1. Repository of scientific and media publications on wider uses of neuroimaging;
2. Transcriptions of all workshops' individual discussion groups and group feedback on specific topics.
3. Video recordings of all presentations available on the web (see [www.sinapse.ac.uk](http://www.sinapse.ac.uk));
4. Video recordings of all discussions available in a repository;
5. Repository of all media coverage of the project

#### b. Peer-reviewed publications

1. Systematic review of non-traditional uses of neuroimaging and their presentation in lay and scientific press, comparing attitudes, accuracy of reporting and scientific content;
2. Paper describing the expert and lay opinions;
3. Paper describing the process of debate and main conclusions and recommendations arising from the workshops.
4. Paper describing the process of the workshops and key outcomes in *SCRIPTed*;
5. Special edition of the journal *Cortex*, on neuroimaging in society (approx 15-18 short articles reflecting topics addressed in the Workshop talks by the speakers with discussion forum for continuing debate)
6. Special edition of the online journal *SCRIPTed* – approx 7-10 full articles on topics addressed in Workshop talks by the speakers – including article on Campbell Collaboration and importance of evidence-based use of neuroimaging and related technologies as forensic evidence.
7. Church of Scotland report on technologies.

#### c. Non-peer reviewed publications about the project

1. British Neuroscience Association (BNA) paper.
2. Holyrood Magazine article.

#### **d. Spin off projects and other outputs**

1. The material is now part of an ongoing PhD on science and politics (Escobar);
2. Pilot for doctoral student or post-doc attachment to Parliament (potential focus for future science policy studentship funding applications) now under discussion;
3. Leverhulme Trust grant on science and policy: An application to Leverhulme on the impact of social media on science reporting and understanding and their uptake by law and politics, is under preparation (BS), which features neuroimaging as one of the there case studies.
4. Some materials passed to Royal Society to assist with their internal review of emerging uses of neuroscience technologies including neuroimaging.
5. Module on neuroimaging in society in University of Edinburgh online MScs in *Neuroimaging for Research* and in *Psychology of Science and Society* also available as online Continuing Professional Development (CPD) materials for use by members of the imaging and other scientific and medical sectors and for public use.
6. CPD (continuing professional development) materials for SINAPSE students and staff and,
7. The case studies that were used in Workshop 2 are now integrated in the elective Honours course “Evidence Interpretation and Evaluation” for the LLB at Edinburgh University.
8. Edinburgh Science Festival debate April 2011
9. Science in Scotland annual meeting 2010 info on SINAPSE stand
10. Conference presentations – Science and Public (June 2011, O Escobar); European Consortium for Policy Research (2011 O Escobar); BNA (2011); BSA; invited talks in York 2011 (JMW); Edinburgh Neuroscience Annual Meeting 2011; SINAPSE Annual Meeting 2011; other work ongoing

#### **e. Specific recommendations**

1. List of “frequently asked questions” to guide the legal profession in forensic uses of neuroimaging for SCRIPTed website.
2. List of recommendations to funding bodies (eg encourage interdisciplinary studentships between law and medicine or law and neuroscience; targeted funding calls for research into ethical implications of emerging technologies and into improved methods for enhancing public understanding of science).
3. Recommendation that forensic uses of neuroimaging need to become evidence-based (paper in SCRIPTed, PAGES).
4. That the House of Commons Select Committee report on “Forensic technology on trial” recommendation to establish an Advisory Committee on Forensic uses of technology should be implemented.

## **f. Taking forward at Government/National level**

1. MSP proposal for a Members Debate in the Chamber of the Parliament,
2. Presenting the project findings to a subject Committee, eg Health or Justice;
3. Presenting to the Cross Party Group on Science and Technology;
4. Presenting to the Scottish Science Advisory Committee (the work has already been presented very briefly to the SSAC at the IAS as part of a showcase of IAS).
5. Science Debate in Parliament (Nov 2010 or 11).
6. Scottish Law Commission possible topic to consider for legal reform (BS).
7. Presentation to Scottish government officials
8. Presentation to Westminster Science and Technology Committee or related (JDW).

#### **4. Overall added value of the programme and its potential impact**

This programme had considerable added value. As well as achieving its objectives of giving a thorough airing to an important and emerging topic for society, it brought together clinicians and scientists involved in neuroimaging, lawyers, ethicists, those involved in the church, policy makers, science funders and, in so doing, provided a catalyst for many related activities. It has resulted in several publications – three direct (in preparation or about to be submitted at the time of writing) and several others that were not anticipated at the start of the project, but which will be valuable in the fields of neuroscience and law respectively. It has resulted in opportunities to improve understanding of interactions between media and science to improve dissemination of information to the public. It has shown that the public is sceptical of media portrayals of many aspects of science, but that there are still serious risks of misleading claims damaging the credibility of neuroimaging and raising false hopes. It has provided raised awareness of the extent to which neuroimaging is creeping into use in the legal profession, but also provided some options to increase interdisciplinary working that may ultimately help to reduce the chances of miscarriages of justice. The programme has aroused interest amongst others in other parts of the UK and will inform their activities. It has established links with key groups in North America working on similar topics. Perhaps Scotland can take a lead role in establishing bodies such as a Forensic Science Advisory Committee that would assist the legal system (and clinicians, neuroimaging researchers and neuroscientists) in making the best use of powerful new technologies. Perhaps some proactive steps by the neuroscience and medical professions to adopt some sensible self regulation would preempt the need for regulation to be imposed by other authorities.

## Appendix 1: Programme activities

The following **agendas** summarise the programme activities. The methods used have been summarised previously (survey, preparation for each event, methods used to stimulate discussion) and will not be repeated here.

### Part 1: Advances in Neuroimaging and the Implications for Society

*Thursday 6th May 2010*

#### **Introduction and overview of whole programme and Part 1 aims and objectives**

Prof Joanna Wardlaw, SINAPSE and SFC Brain Imaging Research Centre, University of Edinburgh  
(Including a brief resume of different forms of imaging for the non-imaging people in the audience)

#### **Discussion session 1: Imaging – Can imaging reveal the mind in health and disease?**

*Chaired by: Prof David Wyper, Director of SINAPSE and Dept of Medical Physics, University of Glasgow*

##### **Brain Imaging – structural and functional imaging correlates of psychosis and psychopathy**

Prof Stephen Lawrie, Division of Psychiatry, Centre for Clinical Brain Sciences, University of Edinburgh

##### **Ethical issues raised by uses of neuroscience in law – delivered remotely**

Prof Walter Sinnott-Armstrong, Kenan Institute for Ethics, Duke University, USA

##### **Privacy and governance implications of wider societal uses of brain imaging data**

Dr Hester Ward, Medical Director, NHS Information Services Division

##### **Panel Question and Answer Session**

*Speakers from first session*

##### **Discussion Groups**

Group lead discussants - *Walter Sinnott-Armstrong/Peter Sandercock, Sergio Della Sala, Mike Nellis, Jonathan Cavanagh*

##### **Feedback from discussions and agreement on main points and points to carry forward**

Chair: Dr Jane Haley, Edinburgh Neuroscience, University of Edinburgh

#### **Discussion session 2: Imaging - limitations and restrictions**

*Chaired by: Prof Peter Sandercock, Edinburgh Neuroscience, Centre for Clinical Brain Sciences, University of Edinburgh*

##### **Mind reading – can imaging tell what you are thinking? – delivered remotely**

Prof Andreas Kleinschmidt, Director of Research, INSERM-CEA Cognitive Neuroimaging Unit, France

##### **Accuracy, reliability and limitations of functional and structural imaging data**

Dr Daniela Seixas, Dept. of Imaging, Centro Hospitalar de Vila Nova de Gaia, and Faculty of Medicine of Porto University, Portugal

##### **Panel Question and Answer Session**

*Speakers from second session*

**Discussion Groups**

Group lead. Discussants – *Roger Staff, Klaus Kessler, Jeremy Hall, Burkhard Schaeffer*

**Feedback from discussions and agreement on main points and points to carry forward**

Chair: Dr Jonathan Cavanagh, SINAPSE, Dept of Psychiatry, University of Glasgow

*Friday 7th May 2010*

**Discussion Session 3: Imaging and Neuroethics**

*Chaired by: Dr Alison Murray, SINAPSE, Aberdeen Biomedical Imaging Centre, University of Aberdeen*

**The strength of our claims and the strength of our data - do they always go together?**

Dr. Klaus Kessler, Centre for Cognitive NeuroImaging, University of Glasgow

**The role of imaging in neuromarketing – delivered remotely**

Prof Gemma Calvert, Neurosense and University of Warwick

**Neuroimaging: a dose of realism**

Prof Charles Warlow, Centre for Clinical Brain Sciences, University of Edinburgh

**fMRI in impaired consciousness – Future diagnostic opportunities and ethical challenges**

Prof Christian Schwarzbauer, SINAPSE, University of Aberdeen

**Reading our thoughts – the future**

Dr Lars Muckli, University of Glasgow

**Panel Question and Answer Session**

Speakers from third session

**Discussion Groups**

Group lead. Discussants – *Gemma Calvert/Douglas Potter, Daniela Seixas, Lars Muckli, Murdo MacDonald*

**Feedback from discussions and agreement on main points and points to carry forward**

Chair: Dr Janet De Wilde, SINAPSE Executive Director, Central Admin Office, University of Edinburgh

**Discussion Session 4: Summarising and outputs**

**Review draft web questions for public opinion survey**

Mr Garret O'Connell, Brain Imaging and Society Work Package Co-ordinator

**Summarising workshop**

Chairs: Prof Peter Sandercock, Edinburgh Neuroscience, Centre for Clinical Brain Sciences, University of Edinburgh and Prof Joanna Wardlaw, SINAPSE and SFC Brain Imaging Research Centre, University of Edinburgh

**Discuss and agree outputs**

## **Part 2: What is the Legal View?**

(Briefing papers circulated in advance)

*Monday 7th June 2010*

### **Discussion Session 1: Imaging all the people? Brain Imaging in multi-stakeholder perspective**

*Chaired by: Prof Joanna Wardlaw, SINAPSE, University of Edinburgh*

#### **The view from the start: Best of Part 1, a PowerPoint medley**

Burkhard Schafer, Co-Director, SCRIPT Centre for IT and IP law, and Joseph Bell Centre for Forensic Statistics

#### **The view from the Bench**

Jed Rakoff, United States District Judge for the Southern District of New York

#### **The view from the pulpit**

Murdo MacDonald, Church of Scotland; Church and Society Council

#### **Panel Question and Answer Session**

*Speakers from first session*

#### **Discussion Groups**

Group lead discussants - *Alison Murray Till Vierkant, Peter Sandercock*

Issues to be discussed: Creating a 'Brain Imaging and Law FAQ list'

#### **Feedback from discussions and agreement on main points and points to carry forward**

Chair: Dr Jane Haley, Edinburgh Neuroscience, University of Edinburgh

### **Discussion Session 2: Mind, your own business?**

*Chaired by: Burkhard Schafer, SCRIPT, University of Edinburgh*

#### **Mind reading**

Prof Hank Greely Director, Center for Law and the Biosciences, Stanford University

#### **The truth machine**

Prof Mike Nellis, Professor of Criminal and Community Justice, University of Glasgow

#### **In the Twilight Zone of Privacy Law**

Judith Rauhofer, University of Central Lancashire

#### **Panel Question and Answer Session**

*Speakers from second session*

#### **Coffee and Discussion Groups**

Group lead. Discussants - *Jed Rakoff, Burkhard Schafer, Joanna Wardlaw, Judith Rauhofer*

Activity: Analysing a Brain image

#### **Feedback from discussions and agreement on main points and points to carry forward**

Chair: Dr Cyril Pernet, University of Edinburgh

### **Public Lecture**

#### **Neuroscience, Law, and Society - The Coming Revolution**

Prof Hank Greely, Deane F. and Kate Edelman Johnson Professor of Law, Stanford University and Co-Director of the MacArthur Law and Neuroscience Project, USA

Lecture Theatre 1, McCance Building, 16 Richmond Street, University of Strathclyde, Glasgow

Tuesday 8th June 2010

**Discussion Session 3: Mapping the Landscape of Brain Imaging and the law – beyond crime and retribution**

*Chaired by: Dr Mike Nellis, University of Glasgow*

**Brain Imaging: Consent Issues, and Licensing of Storage and Analysis**

Michael Bromby, Glasgow Caledonian University

**Brain imaging and Insurance law**

Gerard Porter, SCRIPT, University of Edinburgh

**Panel Question and Answer Session**

Speakers from third session

**Discussion Groups**

Group lead. Discussants - *Klaus Kessler, Martin Pickersgill,*

Issues to be discussed: Drawing a conceptual map of Brain Imaging and the Law; Identifying training and teaching needs

**Feedback from discussions and agreement on main points and points to carry forward**

Chair: Dr Janet De Wilde, SINAPSE, Central Administration Office, University of Edinburgh

**Discussion Session 4: A fine mess you got us into – Brain Imaging and the notion of responsibility**

*Chaired by: James Chalmers, University of Edinburgh*

**Brain Imaging and responsibility in criminal law - to be delivered by Burkhard Schafer**

Hans Markowitsch, Prof for Physiological Psychology, Bielefeld

**Brain imaging, philosophy and the criminal law**

Till Vierkant, Department of Philosophy, University of Edinburgh

**Panel Question and Answer Session**

Speakers from fourth session

**Discussion Groups**

Group lead. Discussants - *Hank Greely, David Shaw, Michael Bromby,*

Issues to be discussed: “Dear First Minister”... Requests and suggestions for politics and governments

**Feedback from discussions and agreement on main points and points to carry forward**

Chair: *Burkhard Schafer, SCRIPT, University of Edinburgh*

**Round up of Conference: Lessons learned, road ahead.**

**Part 3, A: Public Engagement Discussion**

Friday 25th June 2010

**Welcome and Introduction**

Robert Rae, Director Scotland’s Future Forums

**Brain Imaging: What is it all about? Includes short Q & A session**

Prof Peter Sandercock, Centre for Clinical Brain Sciences, University of Edinburgh



## **Group Work 1 – What do we all make of it?**

Questions: What do you think of Brain Imaging? 2 How do you think the science could and should be used in the future?

## **Future Perspective: Brain Imaging in the year 2025**

Robert Rae, Director Scotland's Future Forums

### **Case Studies from the Future**

*Medical:* It's 2025, and you are applying for life insurance. The insurance company insist that to qualify for a preferable premium, you have to have a brain image. This may show whether you are likely to develop dementia later in life.

- Is it right that the Insurance company can ask you to have this done?
- Should the Insurance company tell you what the scan shows?
- What should politicians and other do in the short and medium term to avoid/ develop this use of brain imaging technology?

*Security:* It's 2025, you are going on holiday. When you arrive at the airport you are asked to have a brain image as part of the "check-in" procedure. This image will be cross referred to a central intelligence computer to ascertain if you have any criminal intentions in your mind.

- Is it right that you have to go through this scan before you board a flight?
- What does the use of this technology mean for civil and human rights?
- What should politicians and other do in the short and medium term to avoid/ develop this use of brain imaging technology?

*Commerce:* It's 2025, a market research company has just undertaken its first brain imaging survey of 1000 consumers to ascertain what their "true" consumer desire are. This information is being used to develop the company's mass marketing strategy based on the research gathered.

- Is it right that commercial companies can use brain imaging as a research tool in this way?
- What does the use of brain imaging technology in this way mean for consumer rights / consumer choice?
- What should politicians and other do in the short and medium term to avoid/ develop this use of brain imaging technology?

It's 2025, and you have applied for a new job. The companies HR department have insisted you undertake a brain imaging procedure. This may show whether you have embellished your cv or have lied at interview

- Is it right that the company will be able to use brain imaging technology in this way?
- What will using this technology mean for your civil/employment rights and business more generally?
- What should politicians and other do in the short and medium term to avoid/ develop this use of brain imaging technology?

*Law:* It's 2025 and your son / daughter has suffered a stroke following a physical attack by a neighbour. The perpetrator's legal team have suggested that the person may be suffering from early schizophrenia and request a brain scan. The scan is inconclusive but the scan shows a shrinkage of the brain which may be down to the early onset of schizophrenia or may be down to excessive alcohol use.

- Should a brain image be used in the court case?
- What affect might this "evidence' have on the jury?

- What should politicians and other do in the short and medium term to avoid/ develop this use of brain imaging technology?

**Presentations by groups on their case studies**

**Next Steps and Close**

**Part 3, B. Policy Makers**

(Briefing papers circulated in advance; results of public and expert survey made available)

*Thursday 19th August*

**Welcome**

Robert Rae, Scotland's Futures Forum

**Summary of debate 1: Neuroimaging in Society**

Prof Joanna Wardlaw, Scottish Imaging Network - A Platform for Scientific Excellence (SINAPSE) and University of Edinburgh

**Summary of debate 2: What is the Legal View?**

Burkhard Schafer, SCRIPT and University of Edinburgh

**Group discussions - discuss ethical questions suggested by Prof Jonathan Moreno**

Facilitated by Professor Jonathan Moreno, David and Lyn Silfen University Professor of Ethics and Professor of Medical Ethics and of History and Sociology of Science at University of Pennsylvania and Center for American Progress, Washington, USA

*Whole room feedback at the end*

**Report of results of the public and expert online survey's: *Seeking opinions on the use of brain imaging technology in society***

Dr Jane Haley, Edinburgh Neuroscience, University of Edinburgh

**Society and the Reception of Technology: the American Experience**

Prof Jonathan Moreno, Professor of Medical Ethics, University of Pennsylvania and Center for American Progress, USA

*followed by a short question and answer session*

**Group discussions - How might the American experience relate to Scotland?**

Followed by whole room feedback

**Reflections on the implications for Scottish policymakers**

Prof Anne Glover, Chief Scientific Advisor, Scotland

**Whole room Feedback - What would we like to say to our politicians?**

Chaired by Prof Anne Glover and Prof Jonathan Moreno

**Next Steps and Closing remarks**

Robert Rae, Scotland's Futures Forum

## Appendix 2: List of participants

### Organizers

*Joanna Wardlaw*, SINAPSE and Edinburgh Neuroscience, University of Edinburgh

*Peter Sandercock*, SINAPSE and Edinburgh Neuroscience, University of Edinburgh

*Janet de Wilde*, SINAPSE Central Administration Office

*Jane Haley*, Edinburgh Neuroscience, University of Edinburgh

*Burkhard Schafer*, Script, University of Edinburgh and Joseph Bell Institute for Forensic Statistics

*Robert Rae*, Scotland's Futures Forum

*Donald Jarvie*, Scotland's Futures Forum

*Jane Morgan*, Scottish Universities Insight Institute (formerly Institute for Advanced Studies), University of Strathclyde

### Part 1 Participants

*Matt Adamson*, Law Student, University of Edinburgh, UK

*Gemma Calvert*, Neurosense Limited and Applied Neuroimaging Group, University of Warwick, UK (Speaker)

*Jonathan Cavanagh*, Department of Psychiatry, University of Glasgow, UK (Chair)

*Neil Dawson*, PsyRING and University of Strathclyde, UK

*Sergio Della Sala*, Department of Psychology, Edinburgh Neuroscience, University of Edinburgh, UK (Chair)

*Oliver Escobar*, Queen Margaret University, Edinburgh, UK (Scribe)

*Madeleine Greal*, Department of Psychology, University of Strathclyde, UK

*Jeremy Hall*, Division of Psychiatry, Edinburgh Neuroscience, University of Edinburgh, UK

*Harriet Johnson*, University of St Andrews, UK (Scribe)

*Klaus Kessler*, Centre for Cognitive Imaging, University of Glasgow, UK (Speaker)

*Andreas Kleinschmidt*, Director of Research, INSERM-CEA Cognitive Neuroimaging Unit, France (Speaker)

*Stephen Lawrie*, Division of Psychiatry, Edinburgh Neuroscience, University of Edinburgh and Scottish Mental Health Research Network, UK (Speaker)

*Murdo MacDonald*, Society, Religion and Technology Project, Church of Scotland, UK

*Calum Mackellar*, Scottish Council on Human Bioethics and Society and Church of Scotland, UK

*Lars Muckli*, Centre for Cognitive Imaging, University of Glasgow, UK (Speaker)

*Alison Murray*, SINAPSE and Aberdeen Biomedical Imaging Centre, University of Aberdeen (Chair)

*Mike Nellis*, Glasgow School of Social Work, University of Strathclyde (Chair)

*Garrett O'Connell*, Division of Psychiatry, University of Edinburgh (Report co-ordinator)

*Cyril Pernet*, SFC Brain Imaging Centre, Edinburgh Neuroscience, University of Edinburgh, UK

*Douglas Potter*, Psychology, University of Dundee, UK

*Judith Pratt*, PsyRING and University of Strathclyde, UK

*Stephanie Schorre*, Law student, University of Edinburgh, UK

*Christian Schwarzbauer*, SINAPSE and Biomedical Imaging Centre, University of Aberdeen, UK (Speaker)

*Kirsten Shuler*, Division of Clinical Neurosciences, University of Edinburgh, UK (Scribe)

*David Shaw*, Dental School, University of Glasgow, UK

*Walter Sinnott-Armstrong*, Department of Philosophy and the Kenan Institute for Ethics, Duke University and Co-Director MacArthur Law and Neuroscience Project, USA (Speaker)

*Roger Staff*, Department of Biomedical Physics, University of Aberdeen, UK

*Daniela Seixas*, Dept. of Imaging, Centro Hospitalar de Vila Nova de Gaia, and Faculty of Medicine of Porto University, Portugal (Speaker)

*Till Vierkant*, Philosophy, University of Edinburgh, UK

*Glenn Walker*, Religion and Technology Project, Church of Scotland, UK

*Hester Ward*, Medical Director Information Services Division, NHS National Services, UK (Speaker)

*Charles Warlow*, Centre for Clinical Brain Sciences, Edinburgh Neuroscience, University of Edinburgh, UK, (Speaker)

*David Wyper*, University of Glasgow and Director of SINAPSE, UK

## **Part 2 Participants**

*Matt Adamson*, School of Law, University of Edinburgh, UK

*Christopher Bechtel*, Society, Religion and Technology Project, Church of Scotland, UK

*Michael Bromby*, School of Law and Social Sciences, Glasgow Caledonian University, UK (Speaker)

*James Chalmers*, School of Law, University of Edinburgh, UK (Chair)

*Pei Ting Chou*, School of Law, University of Edinburgh, UK

*Oliver Escobar*, Queen Margaret University, Edinburgh, UK (Scribe)

*Hank Greely*, Center for Law and Biosciences, Stanford University, USA (Speaker)

*Chris Lever*, School of Law, University of Edinburgh, UK

*Murdo MacDonald*, Society, Religion and Technology Project, Church of Scotland, UK (Speaker)

*Hans Markowitsch*, Department of Psychology, University of Bielefeld, Germany (Speaker, talk delivered by Burkhard Schafer)

*Angela Mathis*, ThinkTank Maths Limited, Scottish Scientific Advisory Committee, UK

*Cyrille Mathis*, France

*Alison Murray*, SINAPSE and Aberdeen Biomedical Imaging Centre, University of Aberdeen, UK

*Shaun Murray*, University of Edinburgh, UK (Scribe)

*Mike Nellis*, Glasgow School of Social Work, Strathclyde University, UK (Speaker and Chair)

*Garrett O'Connell*, Division of Psychiatry, University of Edinburgh, UK (Report co-ordinator)

*Cyril Pernet*, SINAPSE, University of Edinburgh, UK

*Martin Pickersgill*, Social Science, University of Edinburgh, UK

*Gerard Porter*, School of Law, University of Edinburgh, UK (Speaker)

*Emily Postan*, LLM Innovation, Technology and the Law, University of Edinburgh, UK

*Jed Rakoff*, Judge, Southern District of New York, USA (Speaker)

*Judith Rauhofer*, Centre for Law, Information & Converging Technologies, University of Central Lancashire, UK (Speaker)

*Stephanie Schorre*, School of Law, University of Edinburgh, UK

*Sinclair Scott*, Society, Religion and Technology Project, Church of Scotland, UK

*David Shaw*, Dental School, University of Glasgow, UK

*Kirsten Shuler*, Division of Clinical Neurosciences, University of Edinburgh, UK (Scribe)

*Joanna Simpson*, University of Stirling, UK (Scribe)

*Till Vierkant*, Department of Philosophy, University of Edinburgh, UK (Speaker)

*David Wyper*, University of Glasgow and Director of SINAPSE, UK

### **Part 3A: Members of the Public Participants**

*Pat Abel*

*Simon Bradstreet*, Network Director, Scottish Recovery Network

*Joyce Armstrong*

*Bryan Beattie*, Creative Services

*Linda Boyes*, ACOSVO

*Shona Craven*

*Bob Crawford*

*Paola Di Maio*

*June Edgar*

*Oliver Escobar*, Queen Margaret University

*Hugh Farrell*

*Jennifer Fulton*

*Ian Fulton*

*Frances Gallagher*, Deputy chair of RSA Scotland

*David Harvey*

*John Hugan*, Acute Capital Planning Manager, NHS

*Derek Kelter*, Convenor, Inclusion Scotland

*Shona Maciver*, Director, Locofoco Limited

*Calum MacKellar*, Director of Research, Scottish Council on Human Bioethics

*Carol Malcolm*, Inward Investment Specialist

Scottish Enterprise

*John McCafferty*

*Catherine McCall*, University of Strathclyde

*Stephen McCue*

*Marcus McCullough*

*Agnes McGroarty*

*Brian McKechnie*, Scottish Centre for Intergenerational Practice

*Derek Mills*

*Sheila Richmond*, Secretary- Scottish Borders Elder Voice

*Morven Shearer*, Neuroscientist, St Andrews University

*Alex Smith*, Enterprising Solutions (Kirkintilloch)

*Linda Steedman*, Managing Director, eCom Scotland

*James Trolland*

*Jackie Wardlaw*

*Alastair Wardlaw*

*Giles Wheatley*, Cowal Council on Alcohol & Drugs

### **Part 3. B. Policy Makers Participants**

*Joyce Armstrong*

*Fiona Bisset*, Senior Medical Officer/ Consultant in Public Health Medicine, Directorate of Health and Wellbeing

*Jonathan Cavanagh*, SINAPSE, Dept of Psychiatry, University of Glasgow, UK

*Oliver Escobar*, Queen Margaret University, Edinburgh, UK (Scribe)

*Anne Glover*, Chief Scientist Scotland, Science Advisory Council, UK (Speaker)

*Michele Hipwell*, Which

*Klaus Kessler*, University of Glasgow, UK

*Murdo Macdonald*, Church of Scotland, UK

*Angela Mathis*, Science Advisory Council; CEO of ThinkTankMaths, International Technology Commercialization, UK

*Cyrille Mathis*, France

*Mike McCarron*

*Elizabeth McKenzie*, Health Psychology, Queen Margaret University

*Sarah Mee*, The Royal Society, London, UK

*Jonathan Moreno*, Department of History and Sociology of Science, University of Pennsylvania also Center for American Progress, Washington, DC, USA (Speaker)

*Lars Muckli*, University of Glasgow, UK

*Ann Packard*, RSA

*Martin Pickersgill*, Social Sciences, University of Edinburgh, UK

*Christian Schwarzbauer*, University of Aberdeen, UK

*Wendy Smith*, Community Engagement, Regeneration Division, Scottish Govt, UK

*James Trolland*

*Georgina Wardle*

*Peter Wright*

*David Wyper*, University of Glasgow and Director of SINAPSE, UK

### **Part 3 C. Meeting with MSPs, Holyrood, 29th Sept 2010**

*Michael Bromby*, School of Law and Social Sciences, Glasgow Caledonian University, UK

*Janet De Wilde*, SINAPSE

*Helen Eadie*, Health and Sport Committee

*Murray Earle*, Senior Research Specialist, SPICE

*Oliver Escobar*, University of Edinburgh, UK

*Jane Haley*, Edinburgh Neuroscience University of Edinburgh

*Simon Hettle*

*Donald Jarvie*, Scotland's Futures Forum, UK

*Cyrille Mathis*, Scottish Science Advisory Council

*Angela Mathis*, Scottish Science Advisory Council

*Murdo McDonald*, Society, Religion and Technology Project, Church of Scotland, UK

*Des McNulty*

*Jane Morgan*, Scottish Universities Insight Institute, UK

*Douglas Potter*, Psychology, University of Dundee, UK

*Robert Rae*, Scotland's Futures Forum, UK

*Hannu Rajaniemi*, Scottish Science Advisory Council, UK

*Beverly Roberts*, Centre for Cognitive Ageing and Cognitive Epidemiology, University of Edinburgh, UK

*Burkhard Schafer*, School of Law, University of Edinburgh, UK

*Emma Sprooten*, University of Edinburgh

*Roger Staff*, University of Edinburgh, UK

*Stephen Lawrie*, Division of Psychiatry, University of Edinburgh, UK

*Eric Swanepoel*, Office Manager/Researcher for Dr Bill Wilson MSP, Deputy Convener of the CPG on Science and Technology, Scottish Parliament, UK

*Joanna Wardlaw*, SFC Brain Imaging Centre, University of Edinburgh and SINAPSE, UK

*David Wyper*, University of Glasgow and Director of SINAPSE, UK